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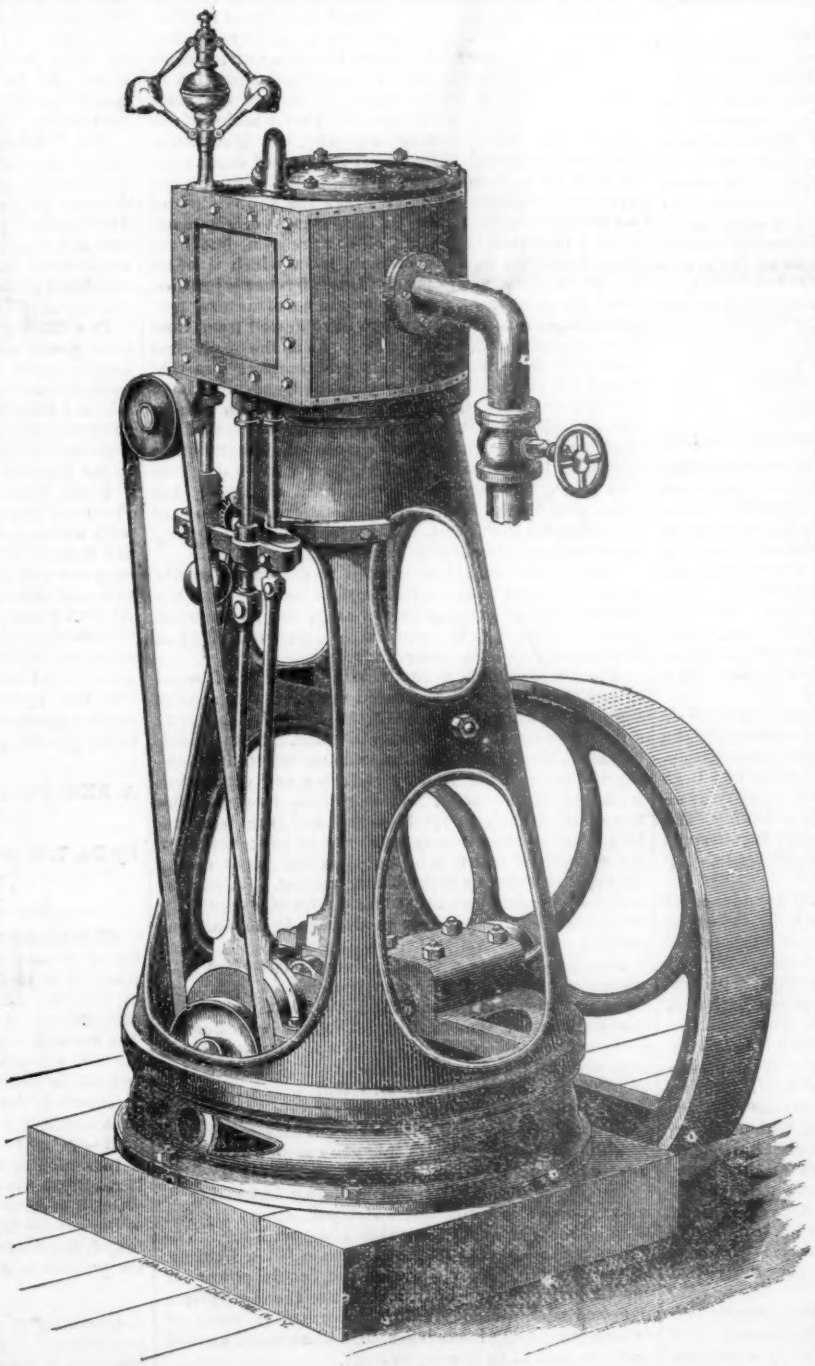
The "Rider" Vertical Steam Engine.

The vertical form of steam engine has always and will always continue to have its advocates. Perhaps the most conspicuous of its merits is the small amount of floor room which it occupies. The engine which we here illustrate is of the inverted vertical kind, that is to say, it has the cylinder at the top and the crank shaft at the bottom; and it is not too much to say that in its design and arrangement the very acme of compactness and stability are attained. The bedplate is of circular form, and the framing is a broad conical column lightened by molded elliptical openings.

The variable cut-off of this engine is substantially like that of the horizontal Rider engine, which instead of having two main valves and two cut-off valves, it has a single main valve and a single cut-off valve. The main valve is of the three port slide kind, only differing from the ordinary three-port valve in having its back hallowed out transversely to form a seat for the reception of the cut-off valve and in having the outer orifices of its steam-ports. The cut-off valve, which slides longitudinally in the concave seat in the back of the main valve, is of the form of a sector of a cylinder, and both of its ends are oblique to correspond with the obliquity of the ports, which, by the action of the separate eccentrics by which the two valves are worked, are always opened to their full width at the commencement of the stroke of the piston, and closed earlier or later in the stroke, according to the rise and fall of the governor. The governor is caused to produce the closing of the ports earlier or later in the stroke by turning the cut-off valve in its seat in the back of the main valve. This action is produced by the action of a toothed rack on the lower part of the governor rod upon a toothed sector, which is suitably geared with the stem of the cut-off valve.



THE "RIDER" VERTICAL STEAM ENGINE.

This engine is manufactured under the patent of Mr. A. K. Rider, of New York City, by Messrs. Handren & Ripley, at the Albany Sheet Iron Works, corner of Albany and Washington streets, New York City. The workmanship is of the very best quality, and its working only requires to be seen to assure any one experienced in the subject that it is a very perfect engine.

Further information may be had of Messrs. M. T. Davidson & Co., Contracting Engineers, 25 John street, New York.

Bursting Pressure of Boilers.—The *Locomotive* says: In casting up the bursting pressure of boilers, it is necessary that some number representing the tenacity of plates one inch thick be decided upon. Some engineers estimate it at 34,000 lbs., while others place it as low as 25,000. These figures suppose the iron to be of the best quality. By an inch of sectional area is understood a sufficient surface of boiler plate of any thickness under one inch, to make a thickness of one inch. In other words, suppose a boiler to be constructed of half-inch iron, and from its end we cut off a section or hoop one inch long, two such sections would be equivalent in quantity of iron to one hoop one inch thick. In testing the strength of iron, bars one inch square are used: in estimating pressure on boiler plates, sufficient surface must be taken for each thickness to equal in quantity a bar of iron one-inch square. If we assume that single-rivited boilers will sustain a strain of 34,000 lbs. per square inch of section the strain on each superficial inch on a plate three-eighth of an inch thick would be three-eighth of 34,000.

A Georgia Editor, to make delinquents "pay up," offers to distribute by lot among those who settle, a gold watch and several other valuable prizes.

Chemical Repertory.--No. 26.

MARCH 16, 1870.

Editor—HENRY WURTZ.

American Chemical News.

NEW YORK LYCEUM OF NATURAL HISTORY.

(CHEMICAL SECTION.)

At the meeting of Monday evening, March 14th, three original chemical papers were read, which we are enabled to present the following abstracts:

ON URINE IN EPILEPTIC SPASMS.

By OSCAR LOEW, Chemical Assistant in the College of the City of New York.

[Read to the N. Y. LYCEUM OF NATURAL HISTORY, March 14, 1870.]

A man of 45 years of age, had almost regularly once a month an attack of epilepsy. During these spasms he always felt a tendency to urinate; and as this urine showed mostly a milky appearance, a sample of it was brought to me by a friend of mine for analysis. This urine had a neutral reaction, was turbid, and had a peculiar odor. The specific gravity was 1.025, the color deep yellow. No trace of sugar could be found; but on examining the flocculent deposit I found that the larger portion of it consisted of albumen.

The urine filtered and mixed with nitric acid or with alcohol, threw down a copious precipitate. The quantity of albumen amounted to nearly one grain in an ounce of urine. Other samples of urine from this man were analyzed, collected during the normal condition of the said individual, but not the slightest trace of albumen could be detected.

In the medical works which I consulted I have met with no remarks on this especial subject. LEHMANN, in his *Physiological Chemistry*, says: Albumen enters into the urine in renal catarrh, in Bright's disease of the kidneys simultaneously with sugar, in diseases of the heart, and in cases of wateriness of the blood, as in dropsy. When the flow of blood is retarded in the capillaries, albumen appears in the urine. The tension of the circulatory system depends upon nervous influence, and as in epileptic spasms there is always excitement of the nerves, the appearance of albumen is easily explained in this way: the ramifications of the nerves in the kidneys arrest, by their influence upon the arterial tubes, the circulation of the blood, and therefore the appearance of albumen.

DINITRONAPHTHYLIC ACID.

By Dr. H. CARRINGTON BOLTON.

[Read to the N. Y. LYCEUM OF NATURAL HISTORY, March 14, 1870.]

This the rather formidable name of a new coloring matter, commonly known in Germany as Martins's yellow. Experiments with a view to obtaining colors from naphthylamine, similar to those prepared from its homologue aniline, have heretofore been only partially successful. PIRIA in 1850 obtained a violet color, and PERKIN and CHURCH, in 1864, prepared a yellow body, but neither proved to be of practical value. Dr. C. A. MARTINS was the first to obtain satisfactory results, and in accordance with his investigations Messrs. BAYER & Co., of Barmen, now prepare the yellow dyestuff on a large scale by the following process:

A solution of nitrate of potash is added to a dilute acid solution of chloride of naphthylamine until the liquid is precipitated red by an alkali (Diazoamidonaphthol). As soon as the naphthylamine has been entirely converted into diazonaphthol a quantity of nitric acid is added, and the liquid heated to boiling. The naphthol in a nascent state is immediately transformed by the nitric acid into dinitronaphthylic acid $C_{10}H_6(NO_2)_2O$.

The reaction begins at 50°C., a great abundance of nitrogen gas is evolved, and the new body swims on the surface of the liquid in the shape of a crystalline spongy mass. It is purified by crystallization from its alcoholic solution, or better by combining it with ammonia, and crystallizing the latter from its solution in water.

As thus prepared dinitronaphthylic acid is nearly insoluble in boiling water, and difficultly soluble in alcohol, ether, and benzol. It is a strong acid, forming salts by direct combination Dr. MARTINS has prepared compounds of soda, potash, ammonia, barium, silver, and lime. The last named is the commercial article.

With regard to the tinctorial powers of this body, its discoverer claims that it is one of the most beautiful and fixed yellow colors known; it dyes silk and wool without mordants in various shades, from lemon yellow to a deep gold color. The coloring power is very great; one kilo of the lime salt suffices to dye 200 kilos of wool deep yellow.

An isomeric form of this acid has been recently discovered by Messrs. DARMSTAEDTER & WICHELHAUS; it is obtained by acting directly on naphthol by a mixture of sulphuric and nitric acids. The dyestuff is called Victoria yellow, and is already employed in Paris for coloring artificial flowers and adulterating gamboge.

EXAMINATION OF A NEW AND EXTRAORDINARY GAS WELL IN THE STATE OF NEW YORK.

By Professor HENRY WURTZ.

[Read to the N. Y. LYCEUM OF NATURAL HISTORY, March 14, 1870.]

THE locality of this outburst of gas is in the Township of West Bloomfield, County of Ontario, and State of New York; about twenty miles south of Rochester, and sixteen miles west of Canandaigua.

It is now about four years since the owner of the ground, named BEEBE, while boring with the hope of getting petroleum, struck the cavity from which the gas flows, at a depth, as he states, of 500 feet. The borehole is tubed down to, and into the solid rock, and the tube stands about ten feet above the surface. This tube is five inches in diameter; and the issuing gas, when *burning*, as it was when I saw it, gives in a still atmosphere a flame some thirty feet in height. The flow has been stated independently by two parties who have measured it with large balloons of known capacity attached to the outlet, to be from four to five feet per second, equivalent to from 15,000 to 18,000 feet per hour, or say, in the mean, at the rate of 400,000 cubic feet of gas per day. From observation on the spot, without any means of exact measurement however, I am prepared to believe the probability of this enormous evolution of combustible gas from the bowels of the rocks. Such a flow really corresponds to a pressure of but a few inches of water. Ten inches will, according to my calculation, drive through a pipe 500 feet long and five inches in diameter 22, 000 feet per hour of gas, of the density which I have found for this, namely, 0. 7. This flow has now gone on for more than four years, and according to the testimony of residents of the vicinity, without any perceptible dimimiution of energy; indicating, in the aggregate, an escape of some 600,000,000 of feet, about half the yearly make of our largest gas manufacturing company, the Manhattan The most remarkable feature is the lack of diminution of flow for so long a time, in connection with the low pressure indicated. I infer hence the probability of an indefinite continuance; as the gas must originate not from a reservoir in a state of compression, but from huge masses or surfaces of rock, from which it oozes out gradually at every pore. This inference is justified from the phenomena of other fountains of natural gas, of which so many are known to have flowed from time immemorial without exhaustion. As to the geological age of the bed from which this gas comes, I was told that Prof. HALL having been consulted, considers it to be most probably the Marcellus Shale; and on consultation with Dr R. P. STEVENS, whose knowledge of the geology of this region is not surpassed, I find him to agree in the probability of this. I cannot dwell in this place, however on the geological question; but must pass to the chemical examinations. These are not yet fully completed, but much that is interesting is nevertheless developed.

The points which I attempted to determine on the ground, though with very imperfect means, were the temperatnre of the gas as it issues, the photometric power (which is quite appreciable), and the effect of intense cold upon the latter.

The temperature—A small semi-cylinder of wood closed at bottom, was cemented with beeswax against the side of the well-tube near the ground, filled with quicksilver, and a thermometer inserted. It was found, however, that the temperature was not constant, showing a heating of the iron by radiation and conduction from the flame above. At one time, however, the temperature sunk to 57° F. so that the true temperature is below this, it may be as low as 50°; very low for a depth of 500 feet. Doubtless the gas is cooled by expansion from a state of compression. (A curious suggestion occurs here regarding causes of irregularity in increase of temperature in descent in fossiliferous rocks)

The Candle power was determined (having had with me a standard candle) by contriving a small photometric room with a large blanket shawl, using of course the RUMFORD or shadow test. The gas was burned from a five-foot steatite-tip bats-wing burner, being first passed through a glass tube so stuffed with cotton as to reduce the pressure just to that which gave the maximum of light. I had not with me an Argand burner, which, especially if with a very contracted throat, would doubtless afford with this gas a somewhat higher candle power.

The Condensation Test was made by immersing in snow and salt, in a common water pail, some sixty feet of small india rubber tubing that I had with me. The thermometer stood at 8° F., 24 degrees below freezing, in the mixture. No change of the candle power occurred during half an hour, and hence the light-giving hydrocarbons present seem to be permanent gases, or at least practically incondensable. Lime-water showed carbonic acid to be largely present.

Samples were taken for analysis, in accurately ground French stoppered bottles, with which, and some quicksilver, I had provided myself. These bottles were stopped under quicksilver, the stoppers having been previously smeared with some thick glycerine. These bottles were then carried to the laboratory of the Manhattan Gas Light Co., and some analyses made; some new methods being used which were devised by myself, in conjunction with Prof. SILLIMAN, and which have not yet been given to the world.

Results of the Analysis.

Marsh Gas	82.41
Carbonic Acid	10.11
Nitrogen	4.31
Oxygen	0.23
Illuminating Hydrocarbons	2.94
	100.00
Density	0.693

Another density determination gave a considerably higher figure; but wishing not to exhaust all my material, I have not repeated it, but have adopted 0.7. Calculation, if we assume the three volumes of unknown illuminants to have a density of 1.5, gives 0.7043.

With regard to these three volumes per cent of illuminant hydrocarbons; as they are absorbed by Nordhausen acid they cannot belong to the saturated hydrocarbons $C^{2n}H^{2n+2}$, and cannot therefore be hydruret of ethylene $C^4H^4H^2$, as found recently according to FOUQUE and GORCEIX in the gases of the Appenines; in most cases in traces only, but in one case to the extent of nearly 18 per cent! (See *Comptes Rendus* lxix, 946.) This seems at first glance in accord with the opinion put forth by FOUQUE, founded, as he says, on the study of the gases from American Petroleum Wells, that the gases of the series $C^{2n}H^{2n+2}$ are especially characteristic of sources of petroleum; but as the almost universal *marsh gas* is itself of this series, being the basis thereof, I cannot see how any such generalization can be made to "hold water." I am still engaged in further examinations of these hydrocarbon constituents, but material is at present insufficient.

The 1 400th volume of free *oxygen* shown is *really present*, as I am convinced, in the gas as it issues, and is not accidental, as FOUQUE and other analysts have deemed traces of oxygen found in such gases to be. The extreme precautions taken by me, both in collection and transportation, as well as in analysis, make me confident of this; but as this involves important chemical and geological conclusions, I shall make further and repeated tests of this point.

In a country and an age like this, such a fountain of heat, power and light as this, cannot be allowed to run long to waste. Many problems have arisen out of the consideration of the best modes of utilizing it, upon which I have been engaged for some time, and the results of the investigations and calculations are very curious and surprising, but not yet ripe for presentation to the LYCEUM. I hope soon to return to the subject.

In the prolonged discussion that followed this paper, Professor SEELY remarked on the enormous pressure with which gases in oil districts sometimes escape. In one case, on the authority of Prof. WINCHELL, the pressure was 180 lbs. to the square inch, in addition to the pressure corresponding to a water column 600 feet high. At such great pressures most condensible gases would exist in the liquid form, to which the surrounding rocky strata would be impermeable, while the incondensible gases might escape. It should therefore be concluded that free hydrogen and nitrogen would be found in smaller quantities in petroleum districts, in proportion to the greater pressure.

A NEW PROCESS FOR THE EXTRACTION OF COPPER FROM ITS ORES.

By Dr. T. S. HUNT, F.R.S., AND JAS. DOUGLAS, JR., ESQ.

[*Concluded from page* 68.]

EXPLANATIONS.

Chloridizing the Copper.—The reaction between protoxyd of copper and protochlorid of iron gives rise to peroxyd of iron, and a mixture of the two chlorids of copper, two thirds being as dichlorid, and one third as protochlorid of copper, as shown in the equation A. The red oxyd or dinoxyd of copper in like manner gives rise to peroxyd of iron, but yields a mixture of two thirds dichlorid and one third of metallic copper, as shown in the equation B:

A.—$3Cu_2O_2 + 4FeCl = 2Fe_2O_3 + 2Cu_2Cl + 2CuCl.$

B.—$3Cu_2O + 2FeCl = Fe_2O_3 + 2Cu_2Cl + 2Cu.$

Inasmuch as the metallic copper (2Cu) set free in B. is readily converted into dichlorid by the protochlorid, (2CuCl) of A, it follows that if not more than one half of the copper be dinoxyd, the remainder being protoxyd, the whole will be chloridized by the action of the protochlorid of iron bath.

Solubility of the Dichlorid of Copper.—While the protochlorid of copper is very soluble, the dichlorid is insoluble in water, but readily soluble in a strong solu-

tion of sea-salt, and of most other chlorids. A saturated brine at a temperature of 194° Fahrenheit, (90° Centigrade,) will hold in solution more than 16 per cent. of dichlorid of copper, and at 104° F. (40° C.) 6.0 per cent., and at 57° F. (14° C.) 3·5 per cent. of dichlorid of copper. When these strong solutions are diluted with water they deposit much of the dichlorid as a white crystalline powder. A solution made with five parts of salt to one hundred of water, dissolves at 194° F. (90° C.) only 2·6 per cent., and at 104° F. (40° C.) only 1.1 per cent. of dichlorid of copper. The above figures are approximate and a little below the results of actual experiment. 100 parts of dichlorid contain 64 parts of metallic copper.

Composition of the Bath.—The equivalent weight of protosulphate of iron or copperas is 139, and that of common salt 58·5, while that of copper is 3·17, and that of iron 28·0. In prescribing the proportions for the bath, numbers a little exceeding these are given, to allow for impurities in the salts employed. To chloridize three equivalents, say 95·1 pounds of copper, which are in the state of protoxyd, two equivalents of protochlorid of iron are produced from 280 pounds of copperas and 120 pounds of salt, dissolved in 100 imperial gallons or 1000 pounds of water. This solution should convert one third of the copper into protochlorid and two thirds into dichlorid, equal to 98·9 pounds of dichlorid of copper. To render this soluble we have prescribed the addition of 200 pounds of 20 per cent. additional of salt to the bath, while, as we have seen, a solution holding but 15 per cent., will dissolve at 194°F., considerably more than this quantity. While these are the theoretical quantities, there is in practice, from a secondary re-action resulting in the formation of an insoluble basic per-salt, a loss of protochlorid of iron amounting to from five to ten per cent., so that the chloridizing power of the bath is somewhat less than above represented. Moreover, if a considerable portion of dinoxyd of copper be present in the ore, the amount of dichlorid will be larger than above calculated. For both of these reasons it is not well to add to the above bath more than 60 or 80 pounds of copper for each 100 gallons. The solution of the copper from a properly prepared ore will be found complete by several hours digestion or percolation, even in the cold, but is more rapid in proportion as the heat approaches the boiling point.

Preparation of the Ores.—In the calcination of carbonates, as recommended, the object is to expel the carbonic acid, which would otherwise cause much effervescence in the bath. When the red or dinoxyd predominates in the ore, this should be, in part at least, converted into protoxyd by calcination in the air, since when alone it leaves one third of its copper undissolved in the bath. In oxydizing sulphuretted ores by roasting till all the sulphur is oxydized, there is obtained a mixture of sulphate of copper with protoxyd and a portion of dinoxyd, which latter, according to Plattner, may amount to 20 or 30 percent. of the copper. Farther roasting at a high heat will convert both this and any sulphate into protoxyd, but this condition is less advantageous, inasmuch as both time and fuel are consumed and the copper is rendered less soluble. The large proportion of dinoxyd, moreover, suffices, as already explained, to convert much of the protochlorid of copper into dichlorid, thereby effecting a saving of iron in precipitating.

Consumption of Metallic Iron.—With few exceptions the copper extracted by solution from its ores is thrown down in the metallic state as cement copper, by means of metallic iron. In theory there are required less than 90 (88·3) parts of pure iron to precipitate 100 parts of copper from a solution of protosulphate or protochlorid, but in practice two or three times as much are consumed. This great consumption of metallic iron is due to two principal causes:

1st. In the ordinary process for extracting copper from its ores by the moist way, acids (and sometimes persalts of iron) are employed to render the copper soluble, either as the principal agents or as auxiliaries. When these are employed the solutions contain more or less of persalts of iron, which consume the metallic iron that would otherwise throw down the copper. Thus an amount of persulphate holding four equivalents of iron consumes five equivalents of metallic iron, and is thereby converted into protosulphate, depositing at the same time four equivalents of iron in the form of an insoluble basic persulphate, which contaminates the cement copper.

2nd. The second cause of the waste of iron is the action of the air. In order to separate the whole of the copper from the solutions a digestion of several days with metallic iron is resorted to. The protosalt of iron, which is formed in this reaction, greedily absorbs oxygen from the air and is thereby converted into a mixture of an insoluble and a soluble persalt. The latter, as above shown, dissolves a quantity of iron in its turn, and yields another portion of insoluble persalt, which falls with the cement copper.

The result of the above causes combined is that instead of 89 parts of iron there are consumed, according to circumstances, from 200 to 300 parts of metallic iron to produce 100 parts of metallic copper in the form of cement copper. This, too, is rendered impure by an admixture of insoluble persalts of iron, generally amounting to from 20 to 40 per cent., and even more. The present process avoids both of these faults, and enables us to obtain a pure cement copper with a very small consumption of iron. The solution obtained with the bath of protochlorid of iron can contain no persalt of iron in solution, and if protoxyd of copper alone has been employed will hold three equivalents of copper combined with two equivalents of chlorine, so that they will be precipitated by two equivalents of iron, being at the rate of 59 parts of metallic iron for 109 parts of metallic copper. If, from the presence of much dinoxyd, or from other reasons, the greater part of the copper be present as dichlorid, it will be remembered that this requires only one equivalent of iron to precipitate two equivalents of copper, being at the rate of 45 parts of iron for 100 parts of metallic copper.

The precipitation of copper from the solutions is at first rapid, especially if these are hot, and kept in agitation. Inasmuch as the waste liquors are not rejected in this, as in the ordinary process, the long digestion with iron required to remove the last portion of copper is dispensed with, and the liquid, after having given up the greater part of its metal, is withdrawn and used for the treatment of a fresh portion of ore. The prolonged action of the air on the bath is thus avoided, and we obtain a cement copper almost entirely free from insoluble iron salts, and with the consumption of a minimum quantity of iron.

The Regenerated Bath.—If the action of the air be excluded it will be found that the bath, after complete precipitation of the copper by iron, will be nearly as rich in protochlorid of iron as before the solution of the copper. The loss which is due to the separation of a portion of oxychlorid of iron during the solution, is variable, and in some cases does not exceed six per cent. The various ways of supplying this loss are three: (1) The direct addition to the bath of a portion of protosulphate or protochlorid of iron. (2) The addition of a portion of sulphate of copper from the roasted ore, and (3) the use of sulphurous acid. Of these the first requires no explanation, and the second and third will be explained under the two following headings. The proportion of iron in the bath should be determined from time to time by the following method: A small portion of the bath, freed from copper by digestion for some hours with metallic iron in a stoppered bottle, is diluted with 50 parts of water, and strongly acidulated with sulphuric acid. A standard solution of permanganate of potash of known strength is then added from a graduated tube so long as it is decolorized. By comparative experiments of this kind on the regenerated bath its strength in protochlorid of iron is readily determined.

The Protosalts of Iron.—In preparing the bath we have recommended either protosulphate or protochlorid of iron. The former salt, being an article of commerce, is to be obtained in many places where the latter cannot be procured, and may be easily manufactured for the purpose in regions where neither of these can be readily obtained, provided sulphuretted copper ores are to be had. It is well known that in roasting these a considerable portion of the copper is converted into sulphate, which may be readily dissolved by water from the roasted ore. If to each 63.4 pounds of copper thus dissolved, we add 120 pounds of common salt, and digest the liquid with metallic iron in a close vessel, best with the aid of heat, till the copper is precipitated, the solution will contain such an amount of protochlorid of iron that it will only be necessary to add 200 pounds of common salt and a sufficient amount of water, to make 100 gallons of the bath of the strength before prescribed.

If a roasted ore, charged with sulphate, be added directly to the bath of protochlorid of iron, it will be found, after precipitating the copper by metallic iron, that the regenerated bath will contain not only the protosalt of iron, corresponding to that originally present in the bath, but also that resulting from the action of the metallic iron on the sulphate of copper introduced, which has given rise to protochlorid of iron and sulphate of soda by double decomposition; thus rendering the bath impure both from the presence of sulphates and from an excess of protochlorid of iron. To obviate these results we add to such roasted ores, (as already described in § 11), so much lime as may be necessary to convert the whole or the greater part of the sulphate of copper, which latter is at once soluble in the protochlorid bath. A small portion of sulphate of copper as above prescribed, may be left undecomposed by lime, and by its re-action with metallic iron will give the protosulphate of iron required to supply the small loss already explained, and keep up the regenerated bath to its original standard, as shown by the test with permanganate.

The use of protosulphate of iron for making the bath, introduces a large proportion of sulphate of soda. A large amount of this, it is true, crystallizes out when the bath is exposed to cold, and may thus be got rid of. Thhe use of a portion of chlorid of calcium may also, as already explained, be resorted to with advantage where this substance can be cheaply procured. In districts where hydrochloric acid is a bye-product of little value it will be best to obtain the protochlorid of iron directly by saturating the crude acid with scrap iron and employing the product as already explained in §3.

Use of Sulphurous Acid.—When the mixture resulting from the action of oxyd of copper upon the bath of protochlorid of iron, is heated and exposed to the action of an excess of sulphurous acid, the whole of the separated peroxyd of iron is converted into a protosalt, and the bath, after precipitation by metallic iron, is found to contain much more protosalt than at first. Such a result is of course to be avoided, but by passing into the bath a small portion of sulphurous acid towards the close of the digestion, it is easy to dissolve such a portion of the precipitated oxychlorid or oxyd of iron as to prevent the loss of iron which otherwise occurs, and keep up the standard of the regenerated bath without the addition of a salt of iron or of sulphate of copper.

Solvent Power of Protochlorid of Copper.—Protochlorid of copper readily attacks metallic copper, forming with it dichlorid. Hence, as already explained, the metallic copper which is separated when the protochlorid of iron bath acts on dinoxyd of copper is at once dissolved if an equivalent of protoxyd of copper be present to yield the requisite amount of protochlorid. The protochlorid of copper will also attack certain sulphuretted compounds of copper. Copper glance, purple copper ore, or artificial products as regulus approaching these in composition, are readily dissolved by a solution of protochlorid of copper mixed with common salt, dichlorid of copper being formed. Hence, a sulphuretted ore perfectly roasted, and still containing a small portion of sulphuret, rich in copper, will give it up to the action of a bath containing protochlorid of copper.

ON THE EXTRACTION OF COPPER FROM ITS ORES.

[*Extract from a letter of* Prof. Sterry Hunt.]

"Professor Henry Wurtz.

"Dear Sir: As you have done me the honor to reprint the specification of the new copper process devised by Mr. J. Douglas and myself, I take the liberty to send you a short notice of the plan followed in our late trials of the process, at Harvey Hill near Quebec. The ores holding about 20 per cent of copper as sulphurets (yellow and purple ore), with a considerable amount of earthy carbonates, were ground, passed through a sieve of forty holes to the linear inch, then roasted in a muffle furnace, after which they held about 5 per cent of copper as soluble sulphate. The roasted ore was treated in a Freiberg barrel with the prescribed bath of protochlorid of iron and common salt, previously heated to about 212° F., and the mixture agitated during six hours; at the end of which time the solution of the copper was so nearly complete, that the gangue did not retain more than half of one per cent. In several trials on solutions thus prepared, and holding from 60 to 100 pounds of copper, it was found that 100 parts of metallic iron threw down from 170 to 172 parts of pure cement copper. The precipitation is very rapid from hot solution, and in twelve hours the regenerated bath is nearly free from copper and fit for the treatment of a fresh portion of ore. To supply by the use of sulphurous acid the loss of the bath in iron salt, we find it preferable to adopt a mode indicated in the American patent (but inadvertently omitted by me in the specification as published by you), which consists in treating by sulphurous acid from the roasting furnace, not the whole of the bath, but the residue of insoluble ferric salt and oxyd left after subsidence, and the withdrawal of the clear copper solution.

"The action of cupric chlorid on sulphuretted ores of copper, such as copper glance and purple copper, which gives rise to cuprous chlorid, is analagous to that long since observed by Karsten between cupric chlorid and sulphid of silver, which yields cuprous chlorid and chlorid of silver; a reaction which lies at the foundation of the Spanish *patio* process for silver ores. We have had occasion to verify this reaction in the case of certain Canadian copper ores holding silver, which is dissolved together with the copper by our bath, and may be readily separated by filtering the solution through cement copper, which throws down metallic silver. Further experiments on regulus from copper ores containing both silver and gold, show that after thus removing the copper and silver, the gold remains with the ferric oxyd in a condition most favorable for chlorination. These results prove that our new copper process may be advantageously applied to the treatment of copper ores holding one or both of the precious metals."

The Mode of Testing Mineral Oils used for Lamps.

By Benjamin H. Paul., Ph.D.

[From the London Chemical News, Jan. 7, 1870]

[*Concluded from page* 68.]

The quantity of vapour given off by mineral oil at the temperature when the first temporary flash takes place, is generally very small, even when the oil itself takes fire at 200° F.: and as the oil in the glass reservoir of a paraffin lamp, while it is burning, seldom acquires a temperature more than about ten degrees above that of the surrounding atmosphere, there would not be much probability of any such quantity of vapor being produced within the reservoir as could give rise to explosion by contact with flame. In regard to this point, however, the construction of the lamp is of considerable importance. In some lamps the pin by which the height of the wick is adjusted is so arranged that there is free communication between the flame of the lamp and the oil reservoir, and between the two there is a small metal chamber, with a hole at the side, through which the pin passes. This chamber, in common with the other brass fitting of the lamp, being heated to a temperature much above 100° F., will of course become filled with vapor given off from the oil as it passes up through the wick; and that vapor, by mixing with air, may form an explosive mixture in the immediate neighbourhood of the flame. In other lamps the pin is fitted in such a way that there cannot be any accumulation of oil vapor near the flame, and there is not any communication between the flame and the reservoir, except through the tube in which the wick is placed. The latter form of lamp is in this respect much preferable to the other, and it is the only kind of lamp in which a very volatile oil can be burnt. But the fact of most importance in regard to the determination of the inflammability of mineral by the "flashing point" is that the result obtained with a given sample of oil in this way, may vary several degrees, according to the mode in which the test is applied. If the surface of the oil is freely exposed to the air, in an open vessel, such as a shallow capsule, the firing point of the vapor may be found to be some degrees higher than when the test is applied in a small widemouthed bottle, or in the reservoir of a paraffin lamp, half-filled with the oil.

The difference before referred to between the temperature at which, in testing oil to ascertain the firing point, the temporary flash takes place, and that at which the oil itself takes fire and continues to burn, also depends very much upon the mode in which the experiment is made. With a shallow, open basin, the difference is much less than it is when a wide-mouthed bottle or a small lamp-reservoir is used. The more freely the surface of the oil is exposed to the atmosphere, the lower will be the temperature at which it takes fire: while, on the contrary, the less freely it is exposed, the lower will be the temperature at which the vapor given off takes fire. Consequently, in fixing a point of temperature as the minimum at which either the oil itself or the vapor it gives off, should take fire by contact with flame, it is necessary that the conditions under which the experiment is to be made should be precisely defined, and that the testing of oils should always be conducted in the same manner, so as to obtain uniform and corresponding results. It is, of course, desirable, also, that these conditions should assimilate as much as possible to those obtaining in a paraffin-oil lamp when it is burning, since any danger that might arise from the inflammability of the oil would exist chiefly in the ordinary use of this material in lamps.

It is singular, however, that the Act passed in 1868, to amend the Petroleum Act of 1852, prescribes a mode of testing mineral oil under conditions that are the direct opposite of those prevailing in the use of the oil. While a mineral oil lamp is in use, the oil is heated in a closed vessel partly filled with air, which thus becomes charged with vapor, proportionately to the volatility of the oil, or part of it, and to the temperature the oil is raised to. Any oil vapor given off is confined; and, if the oil be sufficiently volatile or sufficiently heated, such formation of oil vapor may result in the production of an explosive mixture within the oil-reservoir of a lamp.

On the contrary, in testing mineral oil according to the directions given in the Schedule appended to the Act of 1868, the oil is heated in an open vessel, with the surface freely exposed to the atmosphere. Under these conditions, any oil vapor formed is liable to diffuse away into the surrounding air, and becomes thus so much diluted as to lose its inflammable character. Consequently, the temperature at which the momentary flash takes place with any given sample of oil when a flame is brought near its surface, will be, for that reason, higher than when the escape and dilution of the oil vapor is prevented—as in a paraffin lamp, or by making the test in a partially-closed vessel.

A still more serious interference with the results of the test would be experienced if the operation were conducted in a place exposed to draughts; and probably much of the discrepency in the results of oil-tests has arisin in this way.

But there is yet another source of discrepency in the results of tests made in accordance with the directions of the Petroleum Act, and one which is of far more importance, because no notice is taken of it in those directions, and consequently, its influence may be greater or less according to accident or to the practice of the operator. This source of error lies in the rate at which the oil is heated, or the time occupied in making a test. All that the Act directs in this respect is that "a small flame shall be applied to the bottom of the outer vessel," which serves a water-bath, and that this vessel "shall be filled with cold, or nearly cold, water." Both these directions are extremely vague. But, leaving out of consideration any difference that might arise from using "cold" water at 40° F., or "nearly cold water" at 70° F., the rate of heating the oil from either temperature up to 100° F. has such an influence on the result obtained that there may be a difference of quite 5° in the flashing point of a given sample of oil, accordingly as the heating is made to occupy a longer or shorter time; and this will be the result, even though a "small flame" be used in both cases. Some experiments I have recently made, show that there is a possibility of even greater variation in the result obtained as the "flashing point" of one and the same sample of oil.

Such a defect as this in the prescribed mode of testing mineral oil leaves the practice of this test entirely subject to the option or fancy of the operator; and it is alone sufficient to render the application of the test totally useless for the purpose of determining the character of mineral oil in regard to inflammability, and worse than useless for all the purposes of the Petroleum Act, besides rendering this Act and its application a possible source of serious inconvenience to those engaged in the mineral oil. On these grounds alone, therefore, there seems to be ample need for a revision of the law, and for the adoption of a more suitable test.

Analytical Laboratory, 150 *Fenchurch Street, E. C.*

Professor Tyndall "On Dust and Disease."

Great interest has been excited in England lately by a lecture delivered by the eminent physicist Professor Tyndall, before the Royal Institution of Great Britain, January 21, which we take pleasure in laying before our readers:

Solar light, in passing through a dark room, reveals its track by illuminating the dust floating in the air. "The sun," says Daniel Culverwell," discovers atomes, though they be invisible by candlelight, and makes them dance naked in his beams." In my researches on the decomposition of vapors by light I was compelled to remove these "atomes" and this dust. It was essential that the space containing the vapors should embrace no visible thing; that no substance capable of scattering the light in the slightest sensible degree should at the outset of an experiment be found in the "experimental tube" traversed by the luminous beam. For a long time I was troubled by the appearance there of floating dust, which though invisible in diffuse daylight, was at once revealed by a powerfully condensed beam. Two tubes were placed in succession in the path of the dust; the one containing fragments of glass wetted with concentrated sulphuric acid; the other, fragments of marble wetted with a strong solution of caustic potash. To my astonishment it passed through both. The air of the Royal Institution, sent through these tubes at a rate sufficiently slow to dry it and to remove its carbonic acid, carried into the experimental tube a considerable amount of mechanically suspended matter, which was illuminated when the beam passed through the tube. The effect was substantially the same when the air was permitted to bubble through the liquid acid and through the solution of potash. Thus, on the 5th of October, 1868, successive charges of air were admitted through the potash and sulphuric acid into the exhausted experimental tube. Prior to the admission of the air the tube was optically empty; it contained nothing competent to scatter the light. After the air had entered the tube the conical track of the electric beam was in all cases clearly revealed. This indeed was a daily observation at the time to which I now refer. I tried to intercept this floating matter in various ways; and on the day just mentioned, prior to sending the air through the drying apparatus, I carefully permitted it to pass over the tip of a spirit lamp flame. The floating matter no longer appeared, having been burnt up by the flame. It was therefore organic matter. When the air was sent rapidly through the flame, a fine blue cloud was found in the experimental tube. This was the smoke of the organic particles. I was by no means prepared for this result, for I had thought, with the rest of the world, that the dust of our air was, in great part, inorganic and non combustible.

Mr. Valentin had the kindness to procure for me a small gas furnace, containing a platinum tube, which could be heated to vivid redness. The tube also contained a roll of platinum gauze, which, while it permitted the air to pass through it, ensured the practical contact of the dust with the incandescent metal. The air of the laboratory was permitted to enter the experimental tube, sometimes through the cold and sometimes through the heated tube of platinum. The rapidity of admission was also varied. In the first column of the following table the quantity of air operated on is expressed by the number of inches which the mercury gauge of the air-pump sank when the air entered. In the second column the condition of the platinum tube is mentioned, and in the third the state of the air which entered the experimental tube:

Quantity of Air.	State of Platinum Tube.	State of Experimental Tube.
15 inches	Cold	Full of particles.
15 "	Red hot	Optically empty.
15 "	Cold	Full of particles.
15 "	Red hot	Optically empty.
15 "	Cold	Full of particles.
15 "	Red hot	Optically empty.

The phrase "optically empty" shows that when the conditions of perfect combustion were present, the floating matter totally disappeared. It was wholly burnt up, leaving not a trace of residue. From spectrum analysis, however, we know that soda floats in the air; these organic dust particles are, I believe, the rafts that support it, and when they are removed it sinks and vanishes. When the passage of the air was so rapid as to render imperfect combustion of the floating matter, instead of optical emptiness, a fine blue cloud made its appearance in the experimental tube. The following series of results illustrate this point:

Quantity.	Platinum Tube.	Experimental Tube.
15 inches, slow	Cold	Full of particles.
15 "	" Red hot	Optically empty.
15 " quick	Red hot	A blue cloud.
15 "	" Intensely hot	A fine blue cloud.

The optical character of these clouds was totally different from that of the dust which produced them. At right angles to the illuminating beam they discharged perfectly polarized light. The cloud could be utterly quenched by a transparent Nichol's prism, and the tube containing it reduced to optical emptiness. The particles floating in the air of London being thus proved to be organic, I sought to burn them up at the focus of a concave reflector. One of the powerfully convergent mirrors employed in my experiment on combustion by dark rays was here made use of, but I failed in the attempt. Doubtless the floating particles are in part transparent to radient heat, and are so far incombustible by such heat. Their rapid motion through the focus also aids their escape. They do not linger there sufficiently long to be consumed. A flame, it was evident, would burn thom up, but I thought the presence of the flame would mask its own action among the particles. In a cylindrical beam, which powerfully illuminated the dust of the laboratory, was placed an ignited spirit-lamp. Mingling with the flame, and round its rim, were seen wreaths of darkness resembling an intensely black smoke. On lowering the flame below the beam the same dark masses stormed upwards. They were at times blacker than the blackest smoke I have ever seen issuing from the funnel of a steamer, and their resemblance to smoke was so perfect as to lead the most practised observer to conclude that the apparently pure flame of the alcohol-lamp required but a beam of sufficient intensity to reveal its clouds of liberated carbon. But is the blackness smoke? This question presented itself in a moment. A red-hot poker was placed underneath the beam, and from it the black wreaths also ascended. A large hydrogen flame was next employed, and it produced those whirling masses of darkness far more copiously than either the spirit-flame or poker. Smoke was, therefore, out of the question. What, then, was the blackness? It was simply that of stellar space; that is to say, blackness resulting from the absence from the track of the beam of all matter competent to scatter its light. When the flame was placed below the beam the floating matter was destroyed *in situ*, and the air, freed from this matter, rose into the beam, jostled aside the illuminated particles, and substituted for their light the darkness due to its own perfect transparency. Nothing could more forcibly illustrate the invisibility of the agent which renders all things visible. The beam crossed unseen the black chasm formed by the transparent air, while at both sides of the gap the thick strewn particles shown out like a luminous solid under the powerful illumination. But here a difficulty meets us. It is not necessary to burn the particles to produce a stream of darkness. Without actual combustion currents may be generated which shall exclude the floating matter, and therefore appear dark amid the surrounding brightness. I noticed this effect first on placing a red hot copper ball below the beam, and permitting it to remain there until its temperature had fallen below that of boiling water. The dark currents, though much enfeebled, were still produced. They may also be produced by a flask filled with hot water.

To study this effect a platinum wire was stretched across the beam, the two ends of the wire being connected with the two poles of a voltaic battery, To regulate the strength of the current a rhenstat was placed in the circuit. Beginning with a feeble current the temperature of the wire was gradually augmented, but before it reached the heat of ignition a flat stream of air arose from it, which, when looked at edgeways, appeared darker and sharper than one of the blackest lines of Fraunhofer in the solar spectrum. Right and left of this dark vertical band the floating matter rose upwards, bounding definitely the non-luminous stream of air What is the explanation? Simply this: The hot wire rarified the air in contact with it, but it did not equally lighten the floating matter. The convection current of pure air, therefore, passed upwards among the particles, dragging them after it right and left, but forming between them an impassable black partition. In this way we render an account of the dark currents produced by bodies at a temperature below that of combustion. Oxygen, hydrogen, nitrogen, carbonic acid, so prepared as to exclude all floating particles, produce the darkness when poured or blown into the beam. Coal gas does the same. An ordinary glass shade placed in the air with its mouth downwards permits the track of the beam to be seen crossing it. Let coal gas or hydrogen enter the shade by a tube reaching to its top, the gas gradually fills the shade from the top downwards. As soon as it occupies the space crossed by the beam, the luminous track is instantly abolished. Lifting the shade so as to bring the common boundary of gas and air above the beam, the track flashes forth. After tha shade is full, if it be inverted, the gas passes upwards like a black smoke among the illuminated particles. The air of our London rooms is loaded with this organic dust, nor is the country air free from its pollution. However ordinary daylight may permit it to disguise itself, a sufficiently powerful beam causes the air in which the dust is suspended to appear as a semi-solid rather than as a gas. Nobody could in the first instance without repugnance place the mouth at the illuminated focus of the electric beam and inhale the dirt revealed there. Nor is the disgust abolished by the reflection that, although we do not see the nastiness, we are churning it in our lungs every hour and minute of our lives. There is no respite to this contact with dirt; and the wonder is not that we should from time to time suffer from its presence, but that so small a portion of it would appear to be deadly to man.

And what is this portion? It was some time ago the current belief that epidemic diseases generally were propagated by a kind of malaria, which consisted of organic matter in a state of *motor-decay;* that when such matter was taken into the body, through the lungs or skin, it had the power of spreading there the destroying process which had attacked itself. Such a spreading power was visibly exerted in the case of yeast. A little leaven was seen to leaven the whole lump, a mere speck of matter in this supposed state of decomposition being apparently competent to propagate indefinitely its own decay. Why should not a bit of rotten malaria work in a similar manner within the human frame? In 1836 a very wonderful reply was given to this question. In that year Cagniard de la Tour discovered the yeast plant, a living organism, which when placed in a proper medium, feeds, grows, and reproduces itself, and in this way carries on the process which we name fermentation. Fermentation was thus proved to be a product of life instead of a process of decay.

[*To be concluded in our next.*]

New Mode of Setting Boilers.

Several boilers in Sheffield, England, have been set upon a new plan. By a simple arrangement of fire-clay plates, says the Sheffield *Independent*, so managed as not to contract the capacity of the flue at any single point, the gases, after being thoroughly intermixed, are at four successive stages in their progress through the flue, thrown in thin streams, against the surface of the boiler. No part of the gases can escape this repeated forcible contact with the boiler, and in the process the heat they contain is so thoroughly extracted and absorbed that the result obtained, as approved by careful tests, is the evaporation of nearly 12 pounds of water for every single pound of fuel, common boiler slack being used. This gives a large saving of fuel as compared with the best modes of setting previously in use. The patentees, we understand guarantee a saving of 25 per cent. The apparatus has the additional advantage of being an effective smoke consumer. The plan is applicable to any class of boiler; can be applied without unseating boilers already fixed: and the plates being of fire-clay, the cost is so moderate as to be very soon recovered by the saving of fuel.

[The Salisbury Boiler, now manufactured by the Cold Spring Foundry, is on this principle, but much more effective, evaporating we are informed, 17 lbs. of water, for every pound of fuel.—Eds]

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—Eds.]

A Word in Favor of Clay Retorts.

South Bend, Ind., Feb. 28, 1870.

Messrs Editors: I have been induced to send you these few remarks about the working of Clay Retorts, by noticing complaints about the durability and results from them. If you think they will be of any interest to your readers, you may find room for them in a corner of your valuable Journal.

The first thing, as every one knows who has worked Clay Retorts, is to have a good (I should say white) heat, so high that when you charge a retort the coal will not smother, as it will do if your heat is too low, showing that the charge has chilled your retort, contracted, and opened it sufficient to allow the gas to escape and make a poor yield. I know no rule and think none necessary, but careful and constant observation, will soon tell the heat that gives the best results.

The next, and I think by far the most important matter is, to keep your heat steady, and this can only be done by careful and steady firing, never stuffing the furnace so full that the draft is almost entirely checked, until the fire is half burned down, nor letting the fire get low before renewing. I think a great mistake is made in having the dampers too open, making the retorts excessively hot immediately over the furnace; then when the furnace door is opened, especially when they clinker, there is a strong blast of cold air striking where these former hot blasts struck, will surely chill and fracture any retort. When it is repeated as often as it has to be, is it any wonder that Clay Retorts do not stand; it would be a greater wonder if they did.

Many imagine they can get over the trouble of Clay Retorts cracking and leaking, by getting them set in some approved or improved way: but without good firing, which means having good firemen, (men with some judgment and common sense), the trouble cannot be got over; but with good firemen I think there would be little cause for complaint about the durability or results from Clay Retorts.

I started a bench of three (brick retorts), December, 1868. they have been working steady ever since, and are as good to-day as when they started.

Our yield is 4.60 to 4.84 feet per lb. monthly. We reckon it every morning, and when our yield comes as low as 4.50, we can always account for it by our coal being fine or wet, and our heat getting down. With clean lump coal we always make from 4.80 to 5 feet. This month our yield is 4.98. The coal we use is Youghiogheny, four hour charges or four and one-half, if not in a hurry.

Another thing that is often neglected is to throw the pressure on the retorts (of course I mean where there is no exhauster). I would as soon think of working retorts (especially Clay, without a *pressure gauge*, immediately under the observation of the fireman, as I would think of working a boiler without a steam guage. This connected with your main immediately after it leaves the hydraulic, gives timely warning of clogging in your pipes or purifyers, so they can be relieved without waiting until you have a choke and a blow. Besides this trouble and annoyance, as you let your pressure of the retorts increase, the yield goes down, and the accumulation of carbon increases, and your heats are harder to keep up. Yours truly,

J. W.

Vindication of Fire Clay Manufacturers.

Philadelphia, March 9, 1870.

Messrs. Editors: In one of your recent issues I noticed the report of the Northern Liberty Gas Company, which excited my curiosity and wonder so much, that I cannot but ask you to give these few remarks space in your columns, if you can do so without inconvenience.

In the report there is a very severe reflection on fire brick and clay retort manufacturers, and I think it would be perfectly proper to give the names of the parties from whom the materials were purchased, so that if the assertion of inferior manufacture is grounded (which I am far from believing), the gas community may be benefitted thereby; and on the other hand, if the assertion is without any good foundation, and the bitter experience of the Northern Liberty Gas Company is to be charged to a different cause, that these manufacturers may have an opportunity to vindicate themselves, and probably discover the true cause of the failure of clay retorts at this gas company's works; and if the managers of this company will only go to the right place they can get the same article of fire bricks etc., that they got eight or ten years back, when the manufacturers had not yet lost the "*art of mixing fire clays,*" as the report says.

I merely write this because this report seems to carry with it the idea that the quality of goods of *all* the fire brick and retort manufacturers in the country had deteriorated to such an extent, that it was impossible to get a good article. It may be true of some, but I can also most positively assert that those fire brick manufacturers who have been *long* and favorably known to the community have not deteriorated, but kept up to the standard of their quality, and some have even improved vastly, and of these there is enough to supply the American market fully, so that if any one gets poor fire brick, tiles and retorts, it is entirely owing to their want of judgment, and probably lack of experience in buying these goods.

Yours very respectfully,

P. N.

Coal in China.

Professor A. S. Bickmore, who has visited some of the Chinese mines, read an interesting paper upon the subject before the American Association, from an abstract of which we quote briefly in reference to coal:

The chinese do not mine for coal below the water line, having no proper pumping apparatus. The best coal in the kingdom remains yet undisturbed; but Professor Bickmore doubts if it will ever be found equal in quality to the coal of England or America. Coal was mined in the mountains west of Pekin six centuries ago before its properties were known to European countries, and was found in common use in Pekin by Marco Polo, in the year 1290. There is an important mine at Mun-ti-kau, thirty-five miles southwest of the capital, which Professor Bickmore visited. The coal is carried in sacks of two bushels each to Pekin on camels and donkeys. An incline shaft has been sunk to a very great depth below the surface of the earth, following the drift of the coal, up which the coal is brought on sleds, by man-power, one Chinaman for each sled, the capacity of which is one bushel and a half. No machinery of any kind is in use. No artificial means of ventilation are employed. By reason of the fact that the Chinese do not go below the water line, fire damp is almost unknown. In the north of China coal is ground to a dust and mixed with clay, that it may burn more slowly. The quantity of coal in China is immense. There are large mines in Manchuria, and in the mountains west of the gulf of Lientang, in the province of Shensi, and along the Yangta. South of the Meiling mountains the quality is inferior, but everywhere the supply is inexhaustible. Petroleum also was found 160 years ago in the province of Shensi. Du Halde, in his work on China, compiled from the diaries of Jesuit priests as long as 1725, says: "Its mountains distil a bituminous liquor, which they call 'oil of stone,' and use for lamps."

What in the Sun is the Matter?—The sun is said to appear now as if it had the small pox, so large and numerous are the spots on it, one of which is about as long as one twenty-eighth of the solar diameter, although astronomers give no hint of its area. This spot is black at the centre, and has serrated edges, while its penumbra is wavy at the edge, and stretches in a curve to the right, preserving the general shape of the umbra. There are several indistinct spots to the left and the whole system of them is rapidly undergoing change. Another group, about an eighth of the sun's diameter, followed the one just spoken of, coming from the eastern limb in the northern hemisphere. The penumbra of this contained several separate umbræ, which were all intensely black.

Report of the Bath (Me.) Gas Light Company.

The following Report of the Treasurer of the Bath Gas Light Company, from January 31st, 1869, to January 31st, 1870, we herewith present to our readers:

RECEIPTS.

Sales of gas	$11,178 39	
" " coke, and coal tar	167 52	
Rent and dockage	105 00	
Sagadahoc County, on acct., of stock	600 00	
Edward Gove	100 00	
Profit and loss	4,617 25	
Eureka Milling Company, on account expense	75 00	
Notes payable	1,700 00	$18,543 15
Cash on hand, Jan. 1, 1869.		3,960 66
		$22,503 81

PAYMENTS.

Dividend, No. 15	$3,415 00	
Sundry personal accounts	545 66	
		$3,060 66
Coal	7,271 14	
Lime	235 75	
Repairs	325 71	
Abatements and allowances	90 03	
New retorts and setting	625 96	
		$8,548 59
Extension acct. to new Court House	1,418 80	
Extension acct. to E. Gove, Carriage factory	133 30	
Extension account to Eureka Milling Company	99 85	
Salaries	1,250 00	
		$2,901 95
Government internal revenue tax	327 87	
Government license to manufacture	10 00	
City tax,—$690; less dis., $34 50	655 50	
		$993 37
Pay roll at the gas works	1,105 00	
Bills and notes receivable	323 47	
Expenses	399 83	
Harris Brothers, meters	283 09	
Interest account	54 22	
Gas bills returned uncollected	1,315 65	
Cash on hand	2,618 07	
		$6,099 24
		$22,503 81

ASSETS.

446 Tons of coal at $9.00 per ton	$4,014 00	
53 Casks of lime, $140	74 20	
11 Gas meters	112 00	
Brass stop cocks and gas pipe	67 10	
1 Clay retort, tiles, fire brick, etc.	138 00	
Coke and coal tar	95 00	
Notes and bills receivable	1,639 12	
Cash	2,618 07	
		$8,757 49

LIABILITIES.

Note due Lincoln National Bank, Feb. 22, 1870	1,200 00	
Note due First National Bank, March 27, 1870,	500 00	
		1,700 00

We have carbonized 380 tons Westmoreland and Caledonian Coals, making per Station Meter 2,847,339 cubic feet of Gas, and have delivered to consumers 2,484,069 feet, allowing 30,000 feet remaining in the Gasholder, and 10,000 used in the works—leaves 323,270 feet for condensation and waste—about 11½ per cent. We have 275 consumers, 29 street lamps, and about 3 miles of street mains.

Capital stock, $68,300. Par value of the stock $100

Respectfully submitted,

CHARLES CLAPP, Jr., Treasurer.

Bath, January 31, 1870.

Street Cars Run by Compressed Air.

The *New Orleans Commercial Bulletin* says, a company has been organized in that city to utilize several inventions for the application of condensed air, as a motive power for cars on city railroads, and is soon about to bring the design to a test.

The idea is that each car shall have two cylinders, or tanks, to contain the compressed air, which is to be used as a motor. These cylinders are to be on the top of the cars, and are to be charged at the depot by an engine worked with steam. Metallic cylinders were first tried, but they were found to be too heavy, and the difficulty of the company has been to find a lighter material available for the purpose. Paper cylinders have been determined on, and Capt Rodgers is engaged in making four to be used on the cars, two on each. They are made of strong sheets of paper, laminated to a thickness sufficient to bear the great pressure required to contain the air condensed into them. The several lamina are laid up with glue, and the paper fabric is strengthened with an envelope of cordage. In connection with these cylinders there is to be an engine, for which a special patent has been taken out, to receive the condensed air and rotate the wheels of the car.

One of the cylinders is finished, and has been subjected to a trial of 300 lbs. to the square inch without yielding. Three hundred pounds to the square inch, the inventor states, will suffice as a motor. He says he has with a platform car, experimented on a street railroad with far less power than that, and the experiment resulted satisfactorily. He used two old iron cylinders, weighing 1,600 lbs, which leaked through the riveting, and there were 28 persons on the car.

Starting with but 90 lbs. of pressure to the square inch, and with the weight of cylinders and men mentioned, he made 3½ miles in 7 minutes and 15 seconds. And as to curves, when the motor was reduced to 15 lbs. to use his own words, he went around a street corner "as smoothly as a ball would roll on a billiard table."

Crude Petroleum.

The *New York Bulletin* says: The market for this article, in connection with which several millions of dollars are invested in New York, is just now in a very anomalous condition. The demand for both crude and refined oil for export is at present very limited, though foreign buyers make many inquiries for both, and place their figures in concection with possible bids always at an extremely low point.

Petroleum is manifestly wanted abroad in both the crude and refined state; but foreign shippere are willing to treat in regard to purchases of it only on so low a scale that it has been hitherto found almost impossible to make sales. The price of crude oil suddenly and unexpectedly advanced to four dollars and eighty cents per barrel on Oil Creek recently and to five dollars and ten cents at the same time in Oil City. Those prices, at forty gallons to the barrel, amount to twelve and three-quarter cents per gallon. Add to these prices two dollars and twenty-five cents as the freight from the creek—whence only crude oil is shipped hither— and the price of the article, delivered in New York, with yard charges, etc., paid, reaches about eighteen cents. Notwithstanding this fact, however, New York refiners will not bid more than sixteen and three-quarters cents for "spot" oil, and sixteen and one-half for "futures," while exporters resolutely limit their offers to twenty-one and one-half cents for cargoes. Some foriegn shippers, it should be added, claim that even twenty-one and one-fourth cents is a high price for crude oil by the cargo.

The figures above given represent the actual state of the market at the present time, and we cannot see that they do other than indicate the impossibility of buyers and sellers meeting each other at those prices.

The following table shows the exports of petroleum from the United States, from January 1 to February 15, 1870:

	1870.	1869.
From New York, galls	4,713,213	6,001,067
Boston	225,207	342,325
Philadelphia	3,325,397	2,034,583
Baltimore	77,024	60,361
Portland	..	..
New Bedford	..	..
Cleveland	..	270,000
Total export from the U. S.	8,340,841	9,142,169
Same time 1867	..	8,805,390
Same time 1866	..	4,522,794

Recent American Patents.

Pertaining to Gas, Water, Etc., from the 5th to the 12th March, 1870.

100,041.—Steam Generator.—James Jacobs, Mayaville, Ky.

100,080.—Portable Gas Generator.—Wm. Snodgrass, (assignor to himself and J. M. Browne), Macomb, Ill.

100,084.—Water Ram.—K. W. Stetson, Kingston, Mass Antedated Feb. 18, 1870.

100,085.—Steam Generator.—C. J. Stolbrand, Columbia, S. C.

100,147.—Steam Generator.—Joseph Harrison, Jr., Philadelphia, Pa.

100,171.—Extensible Gas Tube for Chandeliers.—H. L. McAvoy (assignor to himself and Samuel Ault, Jr.), Baltimore, Md. Antedated Feb. 10, 1870.

100,203.—Steam Engine Governor.—William Smith, Philadelphia, Pa.

100,236.—Pressure Blower Wheel.—B. F. Sturtevant, Jamaica Plain, Mass.

100,237.—Pressure Blower Wheel.—B. F. Sturtevant, Jamaica Plain, Mass.

100,238.—Hot-Air Blower.—B. F. Sturtevant, Jamaica Plain, Mass.

100,239.—Pressure Blower.—B. F. Sturtevant, Jamaica Plain, Mass.

100,268.—Hydrocarbon Burner.—Adolphe D. Landsee, Paris, France.

100,270.—Vapor Burner.—Henry C. De Witt, Waukegan, Ill.

100,274.—Carbureter.—Cleaveland F. Dunderdale, N. Y. City.

100,294.—Steam Blower and Exhauster.—John Howarth, Salem, Mass.

100,309.—Purification of Coal Gas.—Emerson McMillin, Ironton, Ohio.

100,354.—Covering for Steam Boilers.—C. A. Baumann, New York City.

100,359.—Combined Engine Boiler and Superheater.—F. B. Blanchard, Spuyten Duyvil, New York. Antedated Feb. 18, 1870.

100,411.—Steam Generator.—W. H. Ivens, Trenton, New Jersey.

100,432.—Manufacture of Illuminating Gas from Coal and other Materials.—George McKenzie, Glasgow, Scotland.

100,443.—Steam Generator.—Henry A. M. Post, Cincinnati, Ohio, assignor to himself, James H. Sheldon, and James T. Sterling.

100,456.—Gas and Water Pipe Plug.—E. P. Schutt Cortland, N. Y.

100,479.—Safety Attachment for Steam Boilers.—Norman Wiard (assignor to himself and Henri L. Stuart), New York City.

100,481.—Valve Cock.—James Wilson (assignor to William Simon), Philadelphia, Pa.

100,483.—Reversing Gear for Steam Engines.—D. A. Woodbury, Rochester, N. Y.

REISSUES.

3,853.—Steam Generator.—W. P. Abendroth, John Griffith, G. W. Wundram, and T. H. Muller, New York City, assignees of T. H. Muller.—Patent No. 83,528, dated October 27, 1868.

3,867.—Process of Treating Petroleum.—J. A. Tatro, Hartford, Conn. Patent No. 99,728, dated February 8, 1870.

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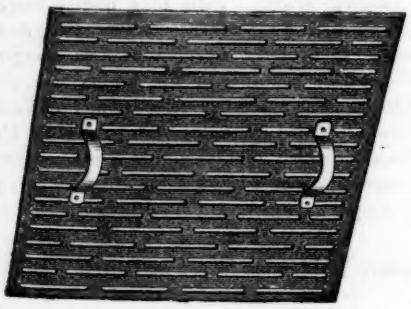

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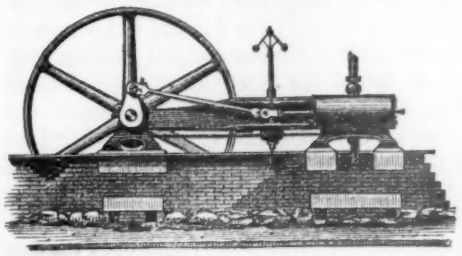

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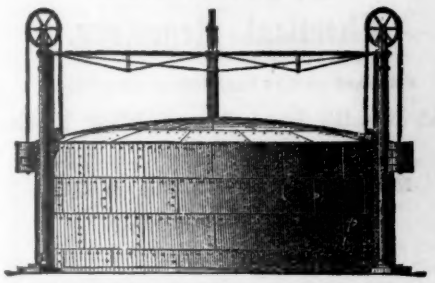

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[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

WEDNESDAY, MARCH 16, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS* or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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CONTENTS.

The "Rider" Vertical Steam Engine..... 81
CHEMICAL REPERTORY—American Chemical News—
On Urine in Epileptic Spasms..... 82
Dinitronaphthylic Acid..... 82
A New and Extraordinary Gas Well in the State of N. Y.. 82
A New Process for the Extraction of Copper from its Ores.. 82
The Mode of Testing Mineral Oils Used for Lamps..... 84
New Mode of Setting Boilers..... 85
CORRESPONDENCE—
A Word in Favor of Clay Retorts..... 85
Vindication of Fire Clay Manufacturers..... 85
Coal in China..... 85
What in the Sun is the Matter?..... 85
Report of the Bath (Me.) Gas-Light Co..... 86
Street Cars Run by Compressed Air..... 86
Crude Petroleum..... 86
Recent American Patents..... 86
EDITORIALS—
Prof. Tyndall's Lecture on "Dust and Disease"..... 88
The Petroleum Gravity Question..... 88
Some Things as Well as Others..... 88

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PROF. TYNDALL'S LECTURE ON "DUST AND DISEASE."

The attention of our readers is called to the publication in this issue of the Journal, of a portion of the lecture delivered by the eminent physicist Prof. TYNDALL, before the Royal Institution of Great Britain, January 21st, the conclusion of which will be given in our next issue. The subject was "Dust and Disease," and has excited great interest in England.

In a series of very striking and beautiful experiments he exhibited the effect of light upon the dust particles of the air, and the powerful reflective properties belonging to them. He showed how these particles could be burnt out by heat, and how the atmosphere could also be cleared of them by passing it through a filter of cotton wool. Finally he dwelt upon the injury done to the lungs, and consequently to health, by ordinary inorganic dust, but more especially he spoke of the organic germs of many diseases which are supposed to find their way into the human system as invisible and extremely minute dust atoms, breathed in with the air.

The germ theory of epidemic diseases, such as the Asiatic cholera, scarlet fever, typhus, and all malaricus fevers, is by no means a new one. It has long been advocated as the best attainable explanation of epidemic phenomena. Physicians, however, are not unanimous in its favor, and many scientific men say that the alleged existence of disease germs in the air are as yet merely an assumption, which must be proved before we can reason upon the subject. But Professor TYNDALL has at least shown that there are myriads of living particles—that is, living in the same sense as plants live, and perhaps as animals also—floating about in the atmosphere of all great cities; and that in London a man breathes into his lungs about thirty-seven and a half millions of these living germs in the space of ten hours. Certainly this fact, taken in connection with many others previously known, greatly strengthens the probability in favor of the germ theory of disease; and if, with Professor TYNDALL, we assume it to be true, the question at once arises, how can we guard against the entrance of these dangerous particles into the body?

Of course, all organic germs cannot be regarded as certainly productive of injury to the human system, but only such as are the seeds of disease. Professor TYNDALL suggests as the best safeguard the cotton-wool respirator, placed so as to cover the mouth and nostrils. It completely filters the air, and all impurities, both living and inorganic, are removed in passing through it. The distinguished lecturer said that in his opinion such respirators must come into general use as a defence against contagion. By means of them the noxious air around a patient may be made pure, and the attendants can breathe it unharmed. For "in all probability," says Professor TYNDALL, "the protection of the lungs will be the protection of the entire system."

These recent experiments and discoveries in this most interesting field of scientific investigation, show us the wisdom of many customary precautions against disease, the reasons of which have not heretofore been clearly understood. Of this character is the custom of kindling fires to purify the atmosphere during the prevalence of an epidemic; also the use of closely woven net curtains in malarious localities as a preventive of fever; and the habit of travellers always to sleep with the mouth closed, and if possible covered, in fever districts. Mr. WALLER, an African traveller, and member of the English Royal Geographical Society, says that while on the banks of the Zambezi river, where the marshes rendered the country particularly unhealthy, his party found much protection from diseases merely tby he use of mosquito curtains. After being tumbled about in travel, the fiber of the material became so frayed as to form in connection with the net-work a fine gauze. The dew, falling at night upon this, formsd a perfect filter for the unhealthy air; and those who used these curtains were able to make long journeys through this miasmatic region without a day's illness from fever.

There is still very much that baffles reason and inquiry in regard to epidemic disease; but if the great questions belonging to this branch of science are ever to be answered, it can only be through the continuance of patient, profound, and practical investigations by able men, such as these of Professor TYNDALL to which we have referred.

THE PETROLEUM GRAVITY QUESTION.

As several correspondents have made inquiries regarding the action of the National Convention of Petroleum refiners held in this city in Febuary last, we append the following:

Dr. Hertz of Pittsburgh introduced the following resolution regarding the specific gravity of crude oil:

Resolved, That the standard gravity of crude petroleum in its natural state shall be 46 deg., and on and after January 1, 1870, all contracts shall be made at and between 44 and 48 degrees gravity. That any such oil bearing gravity above 48 degrees is not merchantable and will not be received by the purchaser except in case of specified agreement as to the reduction beyond that which is provided for on oil up to 48 degrees. If the seller wishes to deliver crude oil of a gravity lighter than 46 degrees and not over 48, he shall make a deduction of 3½ per cent on the price paid per barrel or gallon for each degree or part of a degree above 46 degaees; and in the same manner if the seller shall deliver pure oil not adulterated below 46 degrees and not below 44, then the buyer shall allow the same amount (3½ per cent) upon each and every degree.

The resolution was unamiously adopted. Mr. Forsyth offered the following resolution, which was adopted.

Resolved. That a committee of Three be appointed to have made accurate instruments for testing crude oil, and have them sent to the different petroleum associations throughout the country, and these shall be considered and accepted as the standard instruments.

Messrs. Flagler of Cleveland, Dr. Hertz of Titusville, and Wicks of New York were appointed such committee. Mr. B. W. Morgan asked Mr. Wicks to take the chair, and afterward offered the following resolution:

Resolved. That from and after the 1st day of January, 1870, we will not sell oil except by actual weight and tare, and that a committee be appointed to meet the exporters, and arrange the mode and number of pounds per gallon of refined oil

Mr. Livingston of Pittsburgh sustained the motion offered by his brother delegate, and stated that the Pittsburgh refiners had already adopted the system of weights, believing it to be the only mode os just measurement. He explained in an ingenious manner the many opportunities that offered for false measure by the guaging system. False rods, unever barrel staves and heads, and the scarcity of standard measures, were particularly referred to. Mr. Morgan strongly urged the adoption of his motion, and denounced the guaging system as defective and untrustworthy, and concluded by stating that he had in his possession a statement that would convince any one that the exporters of this city had been more or less imposed on by the refiners.

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Second.—The illuminating power of gas, it is asserted, depends upon the temperature of the air in which it is burned. Taking the amount of light emitted at 65 deg. Fah. as the standard of 100 parts, it has been ascertained that the illuminating power of gas at 30 deg. is only 33, or one-third of what it is at 65 deg. Increased heat, however, is not attended by a corresponding increase of light, for the illuminating power at 212 deg. is only 104 and at 320 deg. only 118. The condensation of the hydrocarbon vapors, through the effect of cold, is supposed to be the cause of the loss of light.

Third.—Iridium Black.—According to a recent author, iridium, as used in coloring glass and porcelain, gives a tint of such intense blackness, that if charcoal does not make a white mark upon it, all other blacks appear brown by the side of it.

Fourth.—The Hon. Joseph S. Bosworth has been elected President of the resident Alumni of Hamilton College. The Alumni will dine together in the Astor House next month.

Fifth.—The caisson for the foundation of the first pier of the East River Brooklyn Bridge will cost $400,000 when delivered ready for sinking.

Sixth.—Insurance.—It is remarked that the development of insurance in the United States has been very great during the past ten years. At the present time it is computed that the policies against fire and marine losses amount to $3,092,000,000. The life insurance business in the same time, it is asserted, has increased from seventeen companies, issuing 56,000 policies, to over sixty companies, issuing between five hundred and six hundred thousand policies for sums amounting to $1,700,000,000.

Seventh.—The weather in Europe during the first two weeks of February was intensely cold. The *Nord* of Brussels says that the thermometer on February 10 stood at 14 deg. F. The lakes, canals, and ponds were frozen over; navigation on the canals of Charleroi and Willebroeck was interrupted, and that the skaters were enjoying that amusement to their heart's content. In Paris, two deaths from congestion of the brain, caused by the intense cold, have been announced. The *Nord* expresses the opinion that the low temperature is due to two large spots of a diameter of 30 to 40 seconds, now visible by the naked eye on the surface of the sun.

Eighth.—Pneumatic Freight Tubes.—In this century of inventions, ideas that, even to enthusiastic minds, seem visionary and impracticable, have been carried out successfully and profitably. A new project of the doubtful kind seems to have been just brought to public notice in the New York journals, in which large wood cuts and long descriptions of the plan have recently been published. It is stated that a company has been organized for the purpose of constructing a pneumatic tube for the transmission of freight by means of hollow globes. The tubes are to be placed either above or under the ground, and are to be constructed of narrow plank, tongued and grooved, with cemented joints. A track of slightly concave metallic plates is to be laid on the bottom of the tube, and the globes, tightly packed with freight are to be propelled by the exhaustion of air by means of an air pump. It is claimed that a high velocity of the globes can be obtained, and that a line of tubes eight feet in diameter, can be built for $19,000 per mile.

[It would be a matter of interest to know what kind of freight it is expected to carry in these *rotary bows shells.* In what manner could it be packed so that it would not be ground to powder. These spheres would answer as a "tumbling box" to polish castings, and in case grain, for instance, was shipped at St. Louis, it would arrive in New York in the condition of *unbolted flour,* which may be worth considering as another item of novelty to the projectors.]

Ninth.—We may note that a short section of the pneumatic tube railway under Broadway, New York, was thrown open to public inspection a few days ago, and is reported as working very well.

[This is one of the really practical schemes which is founded upon correct scientific principles, and will mark a new era in the progressive enterprises of the times. Of all the numerous projects for metropolitan transit this is the most feasible, and will surely be profitable to the projectors]

Tenth and Last.—A Nashville editor writes: "What heart has not thrilled to the silvery silence which succeeds sweet music, when the delicate harmonies that had ceased to vibrate on the ear were repeated, and each share of melodious meaning translated to the inner sense?" The rhapsody was inspired by hearing a hand organ.

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"Foreman of Boiler Department.

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A FOREMAN WHO IS COMPETENT TO TAKE charge of Gas Making of small Gas Works, and who is a Gas-fitter, and can take Indexes and Set Meters. Best of reference required. Address the undersigned, care of Gas-Light Journal, 22 Pine Street, New York.
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PURIFIERS, ETC., FOR SALE.

EIGHT CAST IRON PURIFYERS, FOUR FEET square, eighteen inches deep, with three tiers of Trays to each, and with Wrought Iron Covers.

Four CAST IRON WASHERS, five feet in diameter, eighteen inches deep.

One CENTRE SEAL complete with the connections, consisting of Pipes, Elbows, Tee Pieces, etc.

The above are all in good order, and will be sold low. Address
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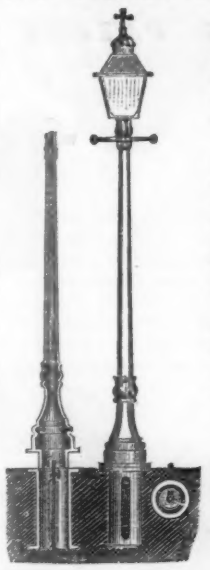
BRANSON'S PATENT LAMP POST.

THE ADVANTAGES OF THIS PATENT POST over the old style, are as follows:



1st. The saving of the base or bottom part of the Post, when the column is broken, the Post being made in two parts. The broken column can be replaced by a new one, without disturbing the base.

2d. When the old style of post is broken, the bottom piece has to be dug out, which cannot be done in winter, or in wet weather: all this is obviated in this Post, as no digging is required. This style of Pos is especially desirable when flag stone sidewalks are used.

3rd. When a stoppage of gas in stand pipe occurs, the column can be lifted out, the pipe detached, cleaned, and replaced in fifteen minutes; no digging being required as is now done with the old Post.

4th. A lighter and better casting can be made from this patent, and it can be handled better, owing to its length and lightness.

5th. In case a broken column cannot be repaired, one third of the original cost is saved by the base being secured and perfect.

Rights for States, or the United States, on reasonable terms. Address, Editors Gas-Light Journal, 22 Pine street, N. Y.

Certificate.

St. Louis, September 1, 1869.

I have examined a new Lamp Post, the Branson patent, and unhesitatingly pronounce it to be the best thing of the kind I have ever seen. Posts of this description have been erected in this city, and in my opinion this style of Post should be universally adopted, as I believe it possesses all the advantages claimed for it.

The St. Louis Gas-Light Company have adapted this Post and ordered a large quantity for immediate use.

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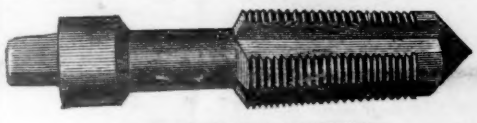

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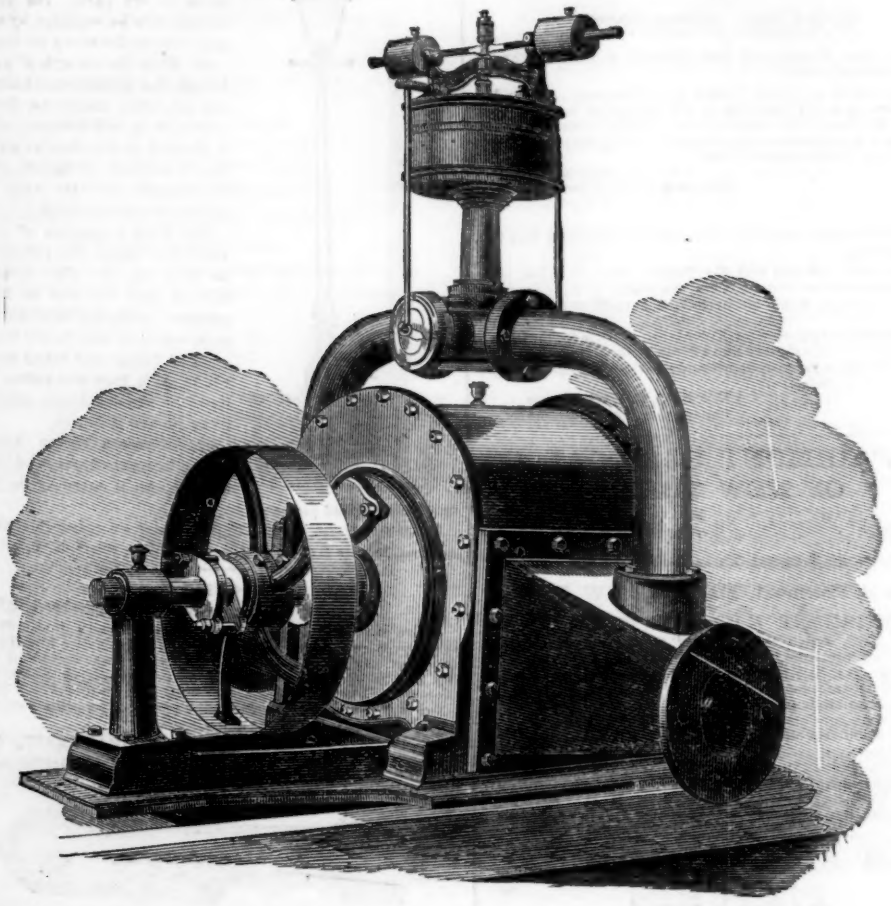

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, eitheclay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

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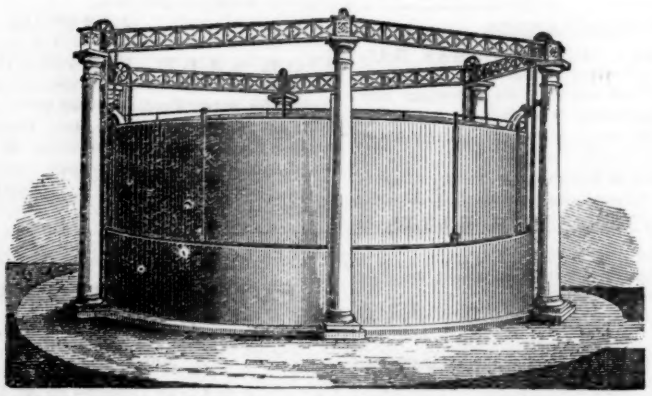

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Make Valves ¼-inch to 24 inch, for Water, Steam & Gas,

FIG. 1.

Fig. 1 shows a single gate valve.

Fig. 2 represents wedge and one-half of gate of double valve, intended for larger sizes, when required to bear heavy pressure either side.

Fig. 3, represents a section through body, gate and wedge.

The slides, G G, are held against wedge D, by ribs, H H, projecting from sides of valve body, A.

In closing the valves, when opening I is covered, slides, G G, pass the lower ends of ribs, H H, when the wedge, D, can move forward on the inclined planes E E, and crowd the gates apart.

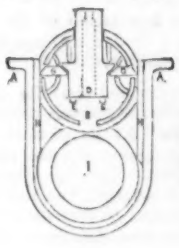

FIG. 3.

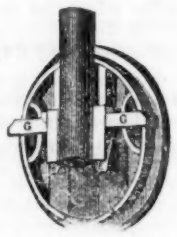

FIG. 2.

[From A. F. Havens, Engineer Brooklyn Gas-Light Co.]

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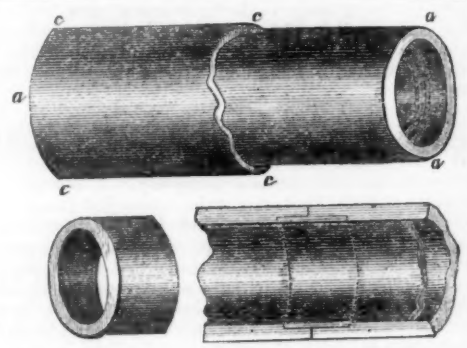
☞ More than 80 Gas and Water Companies have them. Send for Descriptive Circular.



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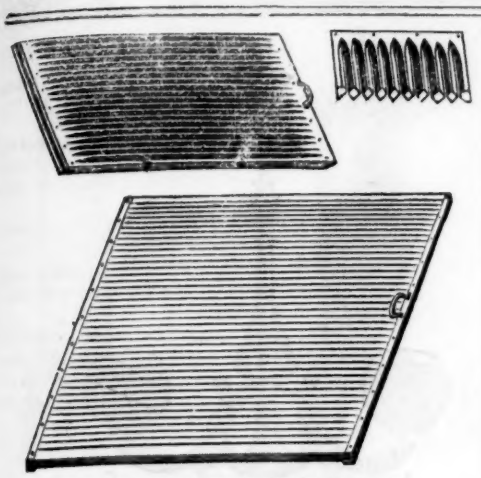

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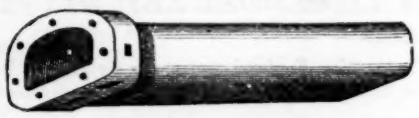

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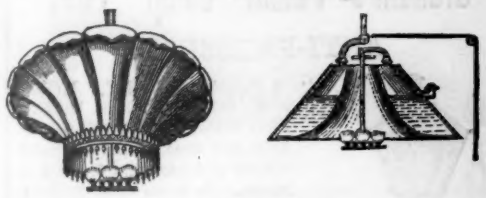

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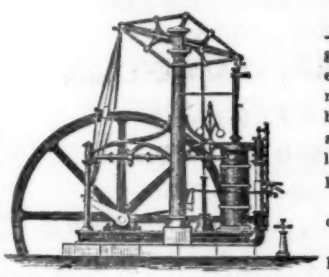

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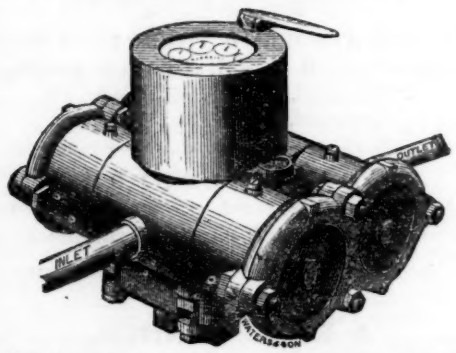

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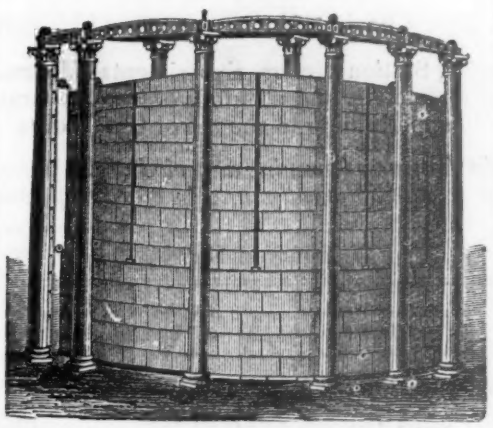

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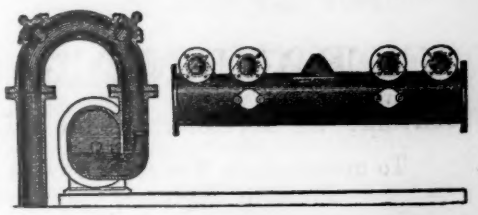

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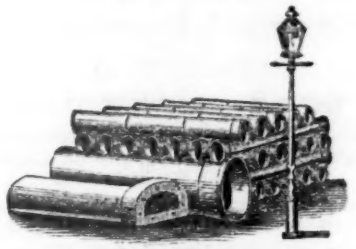

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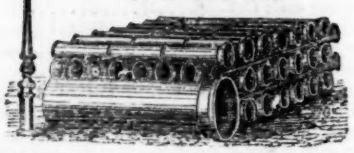

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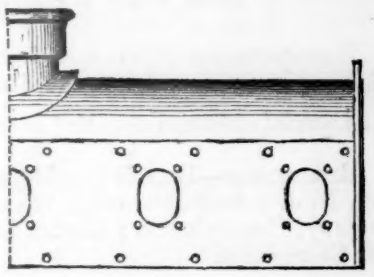

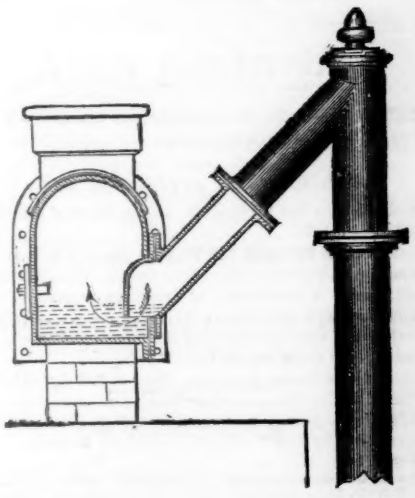

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Lava Gas Tips, etc., etc.—James J. Walworth & Co., 2 Bath st., Boston, Mass 9
Patent Conically Slotted Wood Trays—John L. Cheesman, 147 and 149 Ave. C, N. Y 5
Patent Gas Exhauster—Smith & Sayre, 95 Liberty st 4
Valve Gas Burner—Avery & Co., Springfield, Mass 1
West Fairmount Gas Coal Mines, Office, Baltimore Md 9
Wooden Gas and Water Pipe—Wyckoff Bros. & Co., Elmira 4

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Camden Iron Works, Camden, N. J.—Jesse W. Starr & Sons ... 7
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Finkle & Lyon Sewing Machine Company, 581 Broadway 9
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Patent Lamp Post—Am. Gas-Light Journal, 28 Pine street 5
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